Beidou/GPS Module Datasheet

Name: Ultra High Sensitivity and Low Power GPS/BD Receiver Module

Model NO.: SKM55D

Revision: V2.02

Revision History:

Revision	Description	Approved	Date
V1.01	Initial Release to 001	George	20130228
V2.01	Update office's address	George	20131119
V2.02	Update certification information	George	20170831

General Description

The SkyNav SKM55D Series with embedded GPS/BD antenna enables high performance navigation in the most stringent applications and solid fix even in harsh GPS/BD visibility environments.

It is based on the high performance single-chip architecture, Its –165dBm tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the BD/GPS was not possible before. The UART connector design is the easiest and convenient solution to communication with other electronic equipment.

Figure 1: SKM55D Top View

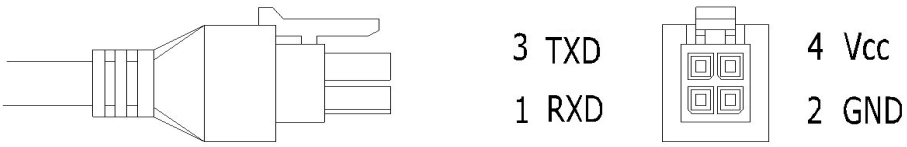
Applications

- LBS (Location Based Service)
- PND (Portable Navigation Device)
- Vehicle navigation system
- Mobile phone

Features

- GPS/BD/GALILEO/QZSS reseiver
- Ultra high sensitivity: -165dBm
- Extremely fast TTFF at low signal level
- Built-in 12 multi-tone active interference canceller
- Ultra low power consumption
- ±11ns high accuracy time pulse (1PPS)
- QZSS, SBAS (WAAS,EGNOS,MSAS,GAGAN)
- Operating temperature range: -40 to 85℃
- RoHS compliance (Lead-free)
- FCC,CE compliance
- Tiny form factor ： 46 * 45 * 15mm

Pin Assignment



Molex Connector

PIN	Color	Signal
1	Red	VCC
2	White	TXD
3	Green	RXD
4	Black	GND

X Connector

Figure 2: SKM55D Series Pin Package

Performance Specification

Parameter	Specification	
GPS/BD receiver		
Receiver Type	GPS/BD2,GALILEO	
Sensitivity	Tracking Acquisition	-165dBm -148dBm
Accuracy	Position Velocity Timing (PPS)	3.0m CEP50 without SA(Typical Open Sky) 0.1m/s without SA 60ns RMS
Acquisition Time	Cold Start Warm Start Hot Start Re-Acquisition	23s 3s 1s <1s
Power Consumption	Tracking Acquisition Sleep/Standby	35mA @3.3V Typical 40mA @3.3V TBD
Navigation Data Update Rate	1Hz	
Operational Limits	Altitude Velocity Acceleration	Max 18,000m Max 515m/s Less than 4g
Antenna Specifications		
Outline Dimension	25 x 25 x 4.0 mm	
Impedance	50 Ω	
Axial Ratio	3 dB max	
Polarization	RHCP	
Mechanical requirements		
Dimension	46*45*15mm	
Weight	90g	
Power consumption		
VCC	3.3V~5V	
Current	50mA(typical)	
Environment		
Operating temperature	-40 ~ +85 ℃ (w/o backup battery)	
Storage temperature	-40 ~ +125 ℃	
Humidity	≦95%	

Hardware Interfaces Configuration

Power Supply: Regulated power for the SKM55D series is required. The input voltage Vcc should be 3.3V~5V, current is no less than 150mA. Suitable decoupling must be provided by external decoupling circuitry(10uF and 1uF). It can reduce the Noise from power supply and increase power stability.

UART Ports: The SKM55D series supports one full duplex serial channels UART. The serial connections are at 2.85V LVTTL logic levels, if need different voltage levels, use appropriate level shifters. the data format is however fixed: X, N, 8, 1, i.e. X baud rate, no parity, eight data bits and one stop bit, no other data formats are supported, LSB is sent first. The modules default baud rate is set up 9600bps.

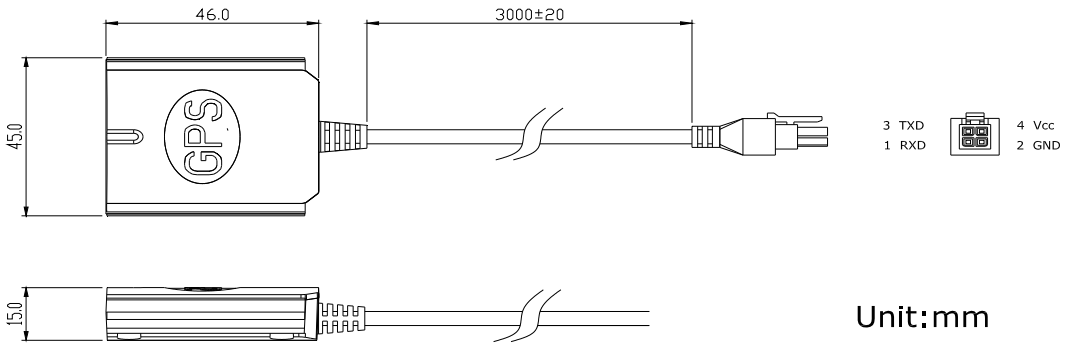
RS232 Ports: The SKM55D series uses single-chip RS232 to UART bridge, It is 3V powered EIA/TIA-232 and V.28/V.24 communication interfaces with low power requirements.

Pin Description

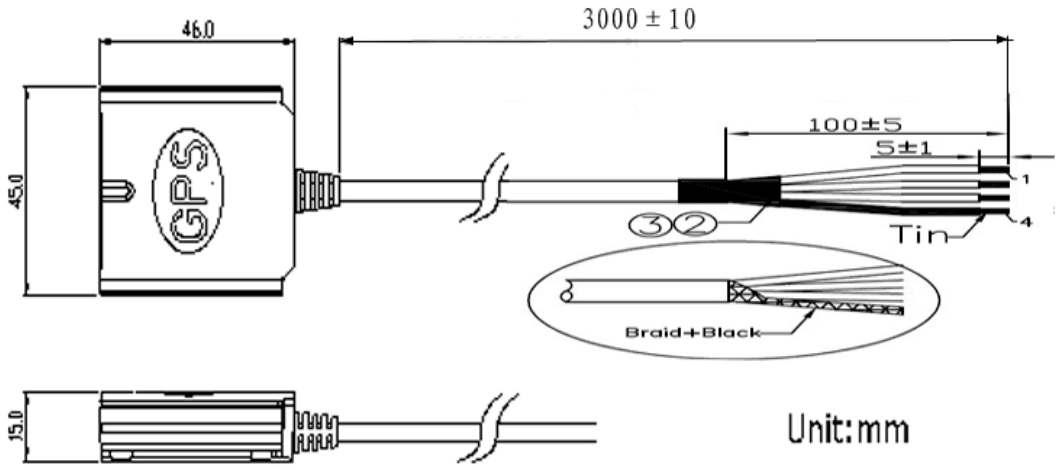
Pin No.	Pin name	I/O	Description	Remark
UART Port (Molex Connector)				
1	TXD	O	TTL:3.1V≥VOH≥2.4V -0.3V≤VOL≤0.4V	
2	GND	G	Power Ground	Reference Ground
3	RXD	I	TTL:3.6V≥VIH≥2.0V -0.3V≤VIL≤0.8V	
4	VCC	P	Power Supply	3.3V~5V
RS232 (Molex Connector)				
1	RXD	O	Data input(RS232 level)	
2	GND	G	Power Ground	Reference Ground
3	TXD	I	Data output(RS232 level)	
4	VCC	P	Power Supply	3.3V~5V

Mechanical Specification

Molex Connector



X Connector



Ordering Information

	Molex (43025-0400)	No connector
UART(TTL)	SKM55DT	SKM55DTN
RS232	SKM55DR	SKM55DRN

Software Protocol

NMEA 0183 Protocol

The NMEA protocol is an ASCII-based protocol, Records start with a $ and with carriage return/line feed. BD/GPS specific messages all start with $GNxxx where xxx is a three-letter identifier of the message data that follows. NMEA messages have a checksum, which allows detection of corrupted data transfers.

The Skylab SKM55D supports the following NMEA-0183 messages: GGA, GLL, GSA, GSV, RMC VTG, ZDA. The module default NMEA-0183 output is set up GGA、GSA、RMC、GSV , and default baud rate is set up 9600bps.

Table 1: NMEA-0183 Output Messages

NMEA Record	Description	Default
GNGGA	Global positioning system fixed data	Y
GNGLL	Geographic position—latitude/longitude	N
GPGSA	GPS DOP and active satellites for GPS	Y
BDGSA	Beidou DOP and active satellites for BD	Y
GPGSV	GPS satellites in view for GPS	Y

BDGSV	Beidou satellites in view for BD	Y
GNRMC	Recommended minimum specific GNSS data	Y
GNVTG	Course over ground and ground speed	N
GNZDA	Date and Time	N

GGA-Global Positioning System Fixed Data

This sentence contains the position, time and quality of the navigation fix.
See RMC for Fix Status, Fix Mode, Fix Date, Speed, and True Course.
See GSA for Fix Type, PDOP, and VDOP.
$GNGGA,013134.000,2232.1711,N,11401.1946,E,1,9,1.17,45.2,M,-2.2,M,,*70
Table 2: GGA Data Format

Name	Example	Units	Description
Message ID	$GNGGA		GGA protocol header
UTC Position	013134.000		hhmmss.sss
Latitude	2232.1711		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	11401.1946		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Position Fix Indicator	1		See Table 2-1
Satellites Used	9		Range 0 to 12
HDOP	1.17		Horizontal Dilution of Precision
MSL Altitude	45.2	meters	Altitude (referenced to the Ellipsoid)
AltUnit	M	meters	Altitude Unit
GeoSep	-2.2	meters	Geoidal Separation
GeoSepUnit	M	meters	Geoidal Separation Unit
Age of Diff.Corr.	<Null>	second	Null fields when it is not Used
Diff.Ref.Station ID	<Null>		Null fields when it is not Used
Checksum	*74		
EOL	<CR> <LF>		End of message termination

Table 2-1: Position Fix Indicators

Value	Description
0	Fix not available or invalid
1	SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3	PPS Mode, fix valid

GLL-Geographic Position – Latitude/Longitude

This sentence contains the fix latitude and longitude.
$GNGLL,2232.1799,N,11401.1824,E,021513.000,A,A*50

Table 3: GLL Data Format

Name	Example	Units	Description
Message ID	$GNGLL		GLL protocol header
Latitude	2232.1799		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	11401.1824		dddmm.mmmm
E/W Indicator	E		E=east or W=west
UTC Position	021513.000		hhmmss.sss
Fix Status	A		A=data valid or V=data not valid
Fix Mode	A		A=autonomous, N = No fix, D=DGPS, E=DR
Checksum	*50		
EOL	<CR> <LF>		End of message temination

GSA-GNSS DOP and Active Satellites

This sentence contains the mode of operation, type of fix, PRNs of the satellites used in the solution as well as PDOP, HDOP and VDOP.

$GPGSA,A,3,25,20,32,29,31,16,,,,,,,1.54,1.26,0.88*13

GPS GSA message: ID1 to ID32 for GPS satellites

$BDGSA,A,3,10,,,,,,,,,,,,1.54,1.26,0.88*17

BD message: ID1 to ID30 for BD satellites

Table 4: GSA Data Format

Name	Example	Units	Description
Message	$GPGSA		GSA protocol header
Mode 1	A		See Table 4-2
Mode 2	3		See Table 4-1
ID of satellite used	28		Sv on Channel 1
ID of satellite used	20		Sv on Channel 2
…	…		…
ID of satellite used	<Null>		Sv on Channel 12 (Null fields when it is not Used)
PDOP	1.14		Position Dilution of Precision
HDOP	0.75		Horizontal Dilution of Precision
VDOP	0.85		Vertical Dilution of Precision
Checksum	*2F		
EOL	<CR> <LF>		End of message termination

Table 4-1: Mode 2

Value	Description
1	Fix not available
2	2D Fix
3	3D Fix

Table 4-2: Mode 1

Value	Description
M	Manual-forced to operate in 2D or 3D mode
A	Automatic-allowed to automatically switch 2D/3D

GSV-GNSS Satellites in View

This sentence contains the PRNs, azimuth, elevation, and signal strength of all satellites in view.

$GPGSV,4,1,13,14,53,105,,16,46,228,27,31,46,011,28,32,39,289,23*72

$GPGSV,4,2,13,29,23,067,20,06,17,183,13,22,16,172,17,20,15,307,29*70

$GPGSV,4,3,13,27,08,188,17,25,07,039,33,03,04,197,17,33,,,*42

$GPGSV,4,4,13,193,,,*40

GPS GSV message: ID1 to ID32 for GPS satellites

$BDGSV,1,1,03,10,46,329,31,08,43,161,,09,40,217,*52

BD GSV message: ID1 to ID30 for BD satellites

Table 5: GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Message	4		Total number of GSV sentences
Message Number	1		Sentence number of the total
Satellites in View	13		Number of satellites in view
Satellite ID	207		Channel 1
Elevation	79	degrees	Channel 1(Range 00 to 90)
Azinmuth	304	degrees	Channel 1(Range 000 to 359)
SNR(C/NO)	34	dB-Hz	Channel 1(Range 00 to 99, null when not tracking)
…			…
Satellite ID	210		Channel 4(Range 01 to 32)
Elevation	60	degrees	Channel 4(Range 00 to 90)
Azimuth	245	degrees	Channel 4(Range 000 to 359)
SNR(C/NO)	28	dB-Hz	Channel 4(Range 00 to 99, null when not tracking)
Checksum	*41		
EOL	<CR> <LF>		End of message termination

Depending on the number of satellites tracked multiple messages of GSV data may be required.

RMC-Recommended Minimum Specific GNSS Data

This sentence contains the recommended minimum fix information.

See GGA for Fix Quality, Sats Used, HDOP, Altitude, Geoidal Separation, and DGPS data.

See GSA for Fix Type, PDOP and VDOP.

$GNRMC,013133.000,A,2232.1711,N,11401.1946,E,0.017,0.00,040513,,,A*4E

Table 6: RMC Data Format

Name	Example	Units	Description
Message ID	$GNRMC		RMC protocol header
UTS Position	013133.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2232.1711		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	11401.1946		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Speed Over Ground	0.017	Knots	
Course Over Ground	0.00	Degrees	True Course
Date(UTC)	040513		ddmmyy
Magnetic variation	<Null>	Degrees	Null fields when it is not Used
Magnetic Variation Direction	<Null>		E=east or W=west (Null fields when it is not Used)
Fix Mode	A		A=autonomous, N = No fix, D=DGPS, E=DR
Checksum	*6B		
EOL	<CR> <LF>		End of message termination

VTG-Course Over Ground and Ground Speed

This sentence contains the course and speed of the navigation solution.

$GNVTG,148.81,T,,M,0.13,N,0.24,K,A*3D

Table 7: VTG Data Format

Name	Example	Units	Description
Message ID	$GNVTG		VTG protocol header
Tcourse	148.81	Degrees	True Course
Reference	T		T = True
Mcourse	<Null>	Degrees	Magnetic Course (Null fields when it is not Used)
Reference	M		M = Magnetic (Null fields when it is not Used)
Speed over ground	0.13	Knots	Nautical Miles per Hour
Units	N		Knots
Speed over ground	0.24	Km/hr	in Kilometers per Hour
Units	K		Kilometer per hour
Mode	A		A=Autonomous, N=No fix, D=DGPS, E=DR
Checksum	*3D		
EOL	<CR> <LF>		End of message termination

ZDA-Date and Time

This sentence contains UTC date & time, and local time zone offset information.

$GNZDA,023345.000,10,04,2010,,*50

Table 8: ZDA Data Format

Name	Example	Units	Description
Message ID	$GNZDA		ZDA protocol header
UTC Time	023345.000		hhmmss.sss
Day	10		UTC time: day (01 ... 31) dd
Month	04		UTC time: month (01 ... 12) mm
Year	2010		UTC time: year (4 digit year) yyyy
local zone hours	<null>		Local Time Zone Offset Hours (Null fields when it is not Used)
local zone minutes	<null>		Local Time Zone Offset Minutes (Null fields when it is not Used)
Checksum	*50		
EOL	<CR> <LF>		End of message termination

NMEA CMD List

Table 9: NMEA CMD List

NMEA CMD TYPE	**NMEA CMD Example:**
Hot Restart	$PMTK101*32<CR><LF>
Warm Restart	$PMTK102*31<CR><LF>
Cold Restart	$PMTK103*30<CR><LF>
Full Cold Restart	$PMTK104*37<CR><LF>
port baudrate	$PMTK251,38400*27<CR><LF>
MODE SET	
BD only mode	$PMTK353,0,0,0,0,1
GPS only mode	$PMTK353,1,0,0,0,0
GPS + BD o mixed mode	$PMTK353,1,0,0,0,1

Skylab M&C Technology Co., Ltd.

Address: 6 Floor,No.9 Building,Lijincheng Scientific&Technical park,Gongye East Road,Longhua District,Shenzhen,Guangdong,China
Phone: 86-755 8340 8210（Sales Support）
Phone: 86-755 8340 8130（Technical Support）
Fax: 86-755-8340 8560
E-Mail: sales1@skylab.com.cn
Website: www.skylab.com.cn www.skylabmodule.com.cn